Gosia Nguyen, PhD - 'Are organic materials the future of flexible electronics?'

Historically, semiconductor devices have been made of inorganic materials such as Silicon, Germanium or GaAs due to their clean and relatively simple processing that enabled high device density on a chip. However, these materials require high-temperature processing, which yields them incompatible with plastic substrates that are required for flexible or biocompatible devices. This is where organic semiconductors (OSCs) come into play as a viable alternative to well-studied inorganic materials. They allow for large-area low-temperature processing below 100C and functional tunability due to the potential of chemical modification of their structural units.

These properties facilitated the widespread of OLED (Organic Light Emitting Diode) displays, and with OSCs surpassing the mobility (a key device parameter) values of their amorphous inorganic counterparts in recent years, Organic Field Effect Transistors (OFETs) have become a solid contestant for building blocks of flexible display backplanes or biosensors. Despite all these advances in organic semiconductor materials research, their long-term operational and environmental instability still pose a major issue and have received inadequate attention in the community.

In this talk, I will briefly outline the differences between organic and inorganic semiconductors, introduce the principles of OFET operation, and discuss what recent advances have been made towards realisation of stable flexible organic electronics. I will also propose two methods of improving the operational stability of OFETs and try to answer the question whether the future of flexible electronics is organic, inorganic or maybe both.